



QP CODE: 26151744



26151744

Reg No :

Name :

MSc DEGREE (CSS) PRIVATE EXAMINATION, MAY 2026

First Semester

M Sc MATHEMATICS

Core Courses - ME010103 - BASIC TOPOLOGY

2019 Admission Onwards

5FB8AFBF

Time: 3 Hours

Weightage: 30

Instructions: (Applicable for 2020 admission onwards): This question Paper contains **two sections**. Answer **section I** questions in the answer book provided. **Section II internal examination questions** must be answered in the **question paper itself**. Follow the detailed instructions given under **section II**.

Part A (Short Answer Questions)

Answer any **eight** questions.

Weight **1** each.

1. Show that every metric space is Hausdorff
2. Compare Cofinite and discrete topology on a finite set
3. For a given family of subsets of X does there exist a topology on X having the family as a base? Justify your answer
4. Show that a subset A is closed in X if and only if $A = \bar{A}$.
5. Define $\mathcal{I} - \mathcal{U}$ continuity at a point. Show that identity function on any space is continuous.
6. Define homeomorphism from a space X to a space Y .
7. Define first countable space. Explain with an example
8. Define mutually separated subset of a space X . Give an example.
9. Define T_0 and T_1 space with example. Give an example of a T_0 space which is not T_1
10. Define complete regular space and $T_{3\frac{1}{2}}$ space

(8×1=8 weightage)

Part B (Short Essay/Problems)

Answer any **six** questions.

Weight **2** each.

11. Show that intersection of two topologies on a same non empty set is again a topology. What about the union.? Justify





12. Consider the real line R as a subset of R^2 . Let τ be the usual topology on R^2 . Show that the subspace $\tau|_R$ coincide with the usual topology on R .
13. Define boundary of a set A . Show that $\bar{A} = \text{int}(A) \cup \partial(A)$, where $\partial(A)$ denotes boundary of A .
14. Let $f : X \rightarrow Y$ be a quotient map, where X, Y are topological spaces. Then prove that a subset A of Y is open in the quotient topology if and only if $f^{-1}(A)$ is open in X .
15. Prove that every cofinite space is compact
16. When a topological property is said to be preserved under continuous functions? Explain with an example.
17. Show that every path connected space is connected. What about the converse. Give justification
18. Show that every T_3 spaces are T_2 but not conversely

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight 5 each.

19. Show that the product topology on the n^{th} power of real line coincide with the usual topology on R^n
20. (i) Define Weak topology
(ii) Define Strong topology
(iii) Show that product topology is the weak topology determined by the projection functions.
21. (a) Prove that closure of a connected subset is connected.
(b) Prove the following (1) Components are closed sets (2) Any two distinct components are mutually disjoint (3) Every nonempty connected set is contained in a unique component (4) Every space is the disjoint union of its components.
22. Show that locally connectedness is a divisible property

(2×5=10 weightage)

